THE EDUCATION LEG OF THE LICENSURE STOOL

NCEES Committee on Education
Workshop outline

- Introduction—Michelle Roddenberry
- ABET accreditation—David Whitman
- International mutual recognition agreements—Stef Goodenow
- NCEES *Model Rules* and the NCEES Education Standards—Michelle Roddenberry
- NCEES Credentials Evaluations Service—Stef Goodenow
- Q&A/panel discussion—all
iPad engagement technology

• Answer polls.
• Submit questions to speakers.
• Click on “Program Information.”
• Take notes and send to yourself.
INTRODUCTION

Michelle Roddenberry, Ph.D., P.E.  
Committee on Education Chair
Committee on Education

• The Committee on Education serves in an advisory role on education issues related to ABET, requirements prior to initial licensure, continuing professional competency (CPC), and foreign degree or unaccredited program evaluation.
Three “legs” of the licensure stool

- Education
- Examinations
- Experience
- The “seat”—continuing professional competency (CPC)
NCEES CPC tracking system

• Initiated at the request of the Education Committee
• Launched in June 2016
• A place for engineers and surveyors to track continuing education with supporting documentation
• Strictly a service for tracking—does not approve courses or providers
• Free service to anyone who has an NCEES account
CPC tracking system features

- Unlimited number of courses can be logged.
- It provides up-to-date tracking for each jurisdiction where you hold a license or for the NCEES CPC Standard.
- Courses are differentiated by area: technical, ethics, business practice, and laws/regulations.
- Courses are differentiated by delivery method: live, online.
- Certificates, syllabi, course descriptions and learning objectives can be uploaded.
ABET ACCREDITATION

David Whitman, Ph.D., P.E.
Education Committee Consultant
What does ABET accredit?

• An academic program leading to a specific degree in a specific discipline
• Misconceptions clarified
  – Not institutions
  – Not schools, college, or departments
Value of ABET accreditation

• ABET-accredited programs recognized globally
  – Commitment to quality education
• Outcomes-based approach
  – “What is learned” vs. “What is taught”
• Emphasis on continuous quality improvement
• Criteria encourage innovation
Generally accepted accreditation principles

• Accreditation is **voluntary**.
• It is conducted by a nongovernmental organization.
• There is a fair and impartial peer review process.
• It requires self-assessment by the program/school.
• It is a continuous process (reviewed every $n$ years).
• Failure of a single criterion results in loss of accreditation.
  – Deficiencies in one **cannot** be compensated by strength in other areas.
ABET accreditation process

• What does it involve?
  – Criteria developed by member societies, practitioners, and educators
  – Self-study report by the institution and program
  – Onsite evaluation by peers
    • From education, government, and industry
  – Publication of lists of accredited programs
  – Periodic reevaluation (maximum six years)
General criteria for B.S. programs

- Students
- Program educational objectives
- Student outcomes—currently (a) through (k), but will be changing
- Continuous improvement
- Curriculum—upcoming changes
- Faculty
- Facilities
- Institutional support
- PLUS—program criteria
ABET’s accreditation activities are organized by commissions.
Commissions

- Academic program leading to a specific degree in a specific discipline—the assigned commission depends on program name
- Applied and Natural Science (ANSAC): associate’s, bachelor’s, master’s
  - Examples: Health Physics, Industrial Hygiene, Industrial and Quality Management, Safety Sciences, Surveying and Mapping
- Computing (CAC): bachelor’s
- Engineering (EAC): bachelor’s, master’s
- Engineering Technology (ETAC): associate’s, bachelor’s
Governance of the commissions

- Each commission has an Area Delegation that approves commissioners from the societies, accreditation criteria changes, document changes, etc.
B.S. versus M.S. accreditation

• A B.S. degree in something like Chemistry, followed by an M.S. degree in Chemical Engineering rarely meets the NCEES Education Standard—unless the M.S. degree is actually accredited by EAC/ABET.

• There are currently very few accredited M.S. programs in engineering.
Degree from an ABET-accredited master’s program

• The master’s program must
  – Support the attainment of student outcomes of Criterion 3 of the general criteria for baccalaureate level engineering programs
  – Include at least one year of math and basic science (basic science include the biological, chemical, and physical sciences), as well as at least one-and-a-half years of engineering topics and a major design experience that meets the requirements of Criterion 5 of the general criteria for baccalaureate level engineering programs

• If a student has an EAC/ABET-accredited B.S. degree, then it is presumed that he or she meets these requirements.
Degree from an ABET-accredited master’s program (cont.)

- The master’s program must
  - Require each student to demonstrate a mastery of a specific field of study or area of professional practice consistent with the master’s program name and at a level beyond the minimum requirements of baccalaureate level programs
  - Require the completion of at least 30 semester hours (or equivalent) beyond the baccalaureate program
  - Satisfy the curricular components of the baccalaureate level program criteria relevant to the master’s-level program name
Changes to EAC/ABET criteria 3 and 5

- It is presumed that the Engineering Area Delegation of ABET will approve these changes at the October 2017 meeting in Baltimore.
- The criteria will go into effect for the 2019–20 accreditation cycle.
Summary of new criteria

• New definitions
  – Basic Science
  – College-level Mathematics
  – Complex Engineering Problems
  – Engineering Science
  – Engineering Design

• New student outcomes
  – (a) – (k) changing to (1) – (7)

• New curriculum changes
Definitions—Basic Science

- Basic sciences are disciplines focused on knowledge or understanding of the fundamental aspects of natural phenomena. Basic sciences consist of chemistry and physics and other natural sciences including life, earth and space sciences.
Definitions—College-level Mathematics

- College-level mathematics consists of mathematics that requires a degree of mathematical sophistication at least equivalent to that of introductory calculus. For illustrative purposes, some examples of college-level mathematics include calculus, differential equations, probability, statistics, linear algebra, and discrete mathematics.
Definitions—Complex Engineering Problems

• Complex engineering problems include one or more of the following characteristics: involving wide-ranging or conflicting technical issues, having no obvious solution, addressing problems not encompassed by current standards and codes, involving diverse groups of stakeholders, including many component parts or sub-problems, involving multiple disciplines, or having significant consequences in a range of contexts.
Definitions—Engineering Science

• Engineering sciences are based on mathematics and basic sciences but carry knowledge further toward creative application needed to solve engineering problems. These studies provide a bridge between mathematics and basic sciences on the one hand and engineering practice on the other.
Definitions—Engineering Design

- Engineering design is a process of devising a system, component, or process to meet desired needs and specifications within constraints. It is an iterative, creative, decision-making process in which the basic sciences, mathematics, and engineering sciences are applied to convert resources into solutions. Engineering design involves identifying opportunities, developing requirements, performing analysis and synthesis, generating multiple solutions, evaluating solutions against requirements, considering risks, and making trade-offs, for the purpose of obtaining a high-quality solution under the given circumstances. For illustrative purposes only, examples of possible constraints include accessibility, aesthetics, codes, constructability, cost, ergonomics, extensibility, functionality, interoperability, legal considerations, maintainability, manufacturability, marketability, policy, regulations, schedule, standards, sustainability, or usability.
Definitions—Team

- A team consists of more than one person working toward a common goal and should include individuals of diverse backgrounds, skills or perspectives.
New student outcomes

(1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science and mathematics

(2) An ability to apply engineering design to produce solutions that meet specified needs with consideration of the public health, safety and welfare, as well as global, cultural, social, environmental and economic factors

(3) An ability to communicate effectively with a range of audiences
New student outcomes (cont.)

(4) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental and societal contexts.

(5) An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks and meet objectives.
New student outcomes (cont.)

(6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions

(7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies
New curriculum requirements

(a) a minimum of 30 semester credit hours (or equivalent) of a combination of college-level mathematics and basic sciences with experimental experience appropriate to the program

(b) a minimum of 45 semester credit hours (or equivalent) of engineering topics appropriate to the program, consisting of engineering and computer sciences and engineering design, and utilizing modern engineering tools
New curriculum requirements (cont.)

(c) a broad education component that complements the technical content of the curriculum and is consistent with the program educational objectives

(d) a culminating major engineering design experience that 1) incorporates appropriate engineering standards and multiple constraints, and 2) is based on the knowledge and skills acquired in earlier course work
International accreditation

• International Accreditation has been growing for the past decade or longer.
• As of October 2016:

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<th>Non-Domestic</th>
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• The ABET accreditation process for programs located outside the United States is identical to the accreditation process for programs within the United States
INTERNATIONAL MUTUAL RECOGNITION AGREEMENTS

Stef Goodenow
NCEES Director of Member Services
ABET’s agreements

• Engineers Canada
• Washington Accord
• Sydney Accord
• Dublin Accord
What it means

• These agreements recognize the *substantial* equivalency of participating organizations’ accreditation processes and their graduates’ preparedness to begin professional practice at the entry level.

• *Substantial equivalency* means that the accreditation systems have comparable standards, outcomes, and processes, even though they may not be identical.
What it doesn’t mean

• These are agreements between international organizations—not an actual accreditation process.

• Each program has not been evaluated in the same manner as when ABET accredits a program.
NCEES MODEL RULES AND
ENGINEERING EDUCATION STANDARD

Michelle Roddenberry, Ph.D., P.E.
Committee on Education Chair
NCEES Model Rules—Engineering

230.10 A (available on iPad)

• Engineering
  – A degree from a bachelor’s or master’s engineering program accredited by the Engineering Accreditation Commission of ABET (EAC/ABET) at the time of the awarding of the degree
  – A degree from an engineering program not accredited by EAC/ABET but that meets the requirements of the NCEES Engineering Education Standard
NCEES Model Rules—Surveying 230.10 B (available on iPad)

- Graduation from a surveying program of 4 years or more accredited by EAC/ABET, the Engineering Technology Accreditation Commission of ABET (ETAC/ABET), or the Applied Natural Science Accreditation Commission of ABET (ANSAC/ABET) at the time of awarding the degree or from a program that meets the requirements of the NCEES Surveying Education Standard as described in Section 130.10 C.1.a in NCEES Model Law.

- Graduation from a program related to surveying of 4 years or more as described in Section 130.10 C.1.b in NCEES Model Law is interpreted to be a bachelor’s degree including surveying courses, mathematics and physical science.
NCEES Engineering Education Standard (available on iPad)

- 32 semester hours math/basic sciences
  - Differential and integral calculus required
  - Two courses in chemistry, calculus-based physics, or biology required (must have two of three)
- 16 semester hours general education
  - Typical humanities/social science coursework
  - Six credits can be from management/business courses
  - 48 semester hours required in engineering science/design
NCEES Surveying Education Standard (available on iPad)

- 18 semester hours math/basic science
  - 12 credits must be in math (can include college algebra)
  - 6 credits must be in science
- 16 semester hours general education
  - General humanities/social science
- 30 semester hours surveying science and practice
“ABET equivalent”? NO!

• Evaluations do NOT determine “ABET equivalency.” ABET performs an outcomes-based assessment of the program, including site visits and evaluation of facilities, faculty, university, etc.

• ABET has a special process to evaluate programs for quality.

• It is nearly impossible to evaluate a nonaccredited program in the same manner using a few official documents from the institution.
Evaluating the education leg

- Licensure mobility
- Consistency
- Protection of the profession
- Protection of the public’s health, safety, and welfare
Audit of NCEES Credentials Evaluations Service (available on iPad)

- Visited NCEES in April 2017
- Participation by several members of the Committee on Education
- Met with NCEES credentials staff
- Found that staff has a very rigorous process for receiving documents, verifying document validity, checking course descriptions, and converting credits
Audit of NCEES Credentials Evaluations Service (cont.)

- Staff is superbly knowledgeable about foreign programs.
- The expertise is on engineering/surveying education AND licensure.
- NCEES has a large database of previous evaluations from university programs all over the world. This ensures consistency among evaluations for applicants across jurisdictions.
- Staff works hard to uphold the intent and requirements of the Engineering and Surveying standards.
Audit of NCEES Credentials Evaluations Service (cont.)

• The evaluations are in a standardized format and easily interpreted by boards.
• Boards have access to any evaluation that has been completed for any individual.
• The evaluation lives forever in E3 (the customer management system).
• Boards have access to helpful staff.
NCEES CREDENTIALS EVALUATIONS SERVICE

Stef Goodenow
Director of Member Services
Who gets an evaluation?

- The bachelor’s degree was completed in a foreign country.
- The applicant finished a non-ABET-accredited engineering program.
- The applicant earned a bachelor’s degree in the United States in another related area (e.g., Physics, Chemistry, Mathematics, Architecture, etc.).
Evaluations we generally do not perform

- Someone with an engineering technology degree (without an earned master’s degree in engineering)
- Any individual’s education that does not have at least a bachelor’s degree (including foreign degrees that we determine are not equivalent to a bachelor’s)
Basic process

- Education entered
- Transcript request form
- Mail received, scanned, and updated
- Education verified—evaluation purchased
- Evaluation completed
Transcript request form
Acceptable coursework

- All college-level coursework will be considered.
  - Bachelor’s
  - Master’s
  - Doctorate
  - Community or technical college
  - CLEP
- Credit will be given for advanced coursework (i.e., completed in high school).
  - Advanced Placement (AP)
  - A-levels
  - Abitur
  - International Lebanese and French Baccalaureate
  - India—Technical Exam Boards and Diploma Programs
- Deficiencies will be noted for any action deemed necessary by a member board.
Credit conversion

• A typical 4-year program totals 128 semester credit hours.
  – 16 per semester, 32 per year
  – 96 for 3 years, 128 for 4 years, 160 for 5 years
  – Example: Eastern Europe
    • Total credit hour system
    • United States 3 semester credit hours = 3 lecture hours per week,
      Russia gives total hours per subject
    • 5-year program with 4,000 hours total – 160/4000 = 0.04
  – Math Analysis I – 200, so 200 x 0.04 = 8 U.S. semester hours
  – The only exception to this is ECTS or a transcript where the institution
did not award credit.
Evaluator process and resources

• Processes
  – Answering questions (applicants have MANY questions)
  – Verification of official documents
  – Analysis of course descriptions and content

• Resources
  – Previous evaluations performed
  – Reference books and manuals
  – Webinars—The refugee crisis and nonverifiable documents issue
Challenging countries

- Syria, Afghanistan, Iraq, Iran
- Cuba
- Former USSR
- Palestine
- Those with religious persecution (Baha’i)
- Those with natural disasters
PANEL Q&A

iPad Questions
2016–17 members of the Committee on Education

- Michelle Rambo-Roddenberry, Ph.D., P.E., Chair
- Bradley Aldrich, P.E.
- Richard Hayter, Ph.D., P.E.
- Sallye Perrin, P.E.
- Robin Petzold, P.S.M.
- Brian Robertson, P.E.
- Kevin Skibiski, P.E., P.L.S.
- Glen Thurow, P.S.
- Dennis Truax, Ph.D., P.E.

- Consultants
  - Richard (Mike) Benton, P.L.S.
  - Edward (Randy) Collins, Ph.D., P.E.
  - James Riney, P.E., P.S.
  - Donna Sentell
  - David Whitman, Ph.D., P.E.

- Board liaison
  - Theresa Hodge, P.E.

- Staff liaison
  - Davy McDowell, P.E.